

as one solid rock; on the contrary, it consists of an infinite number of layers, of varying hardness, like a rock close solid as marble, & under it, or above it, a rock of loose, coarse texture. Now the rain does, like hail, atmosphere moisture in solution form, is laden with carbonic acid, derived from the air itself, or from decaying vegetable matter, and water containing carbonic acid in solution has the property especially ~~of attacking~~ to limestone - not merely wearing it away. How the carbonic acid acts is open to discussion, but the fact remains. ~~does~~ must ^{as underground} account for the rivers, the canes, the paths, the fantastical rock forms of Western Kentucky this district. Add to this the common effect of weathering upon rocks, gnawed herbs throughout, & how the water percolates through the softer lower state, creeps, walls, ^{water} etc. to rock that holds it as it might burst a piston, leaves a picture exposed to the further action of the atmospheric mist is in ever wearing away, as well as dissolving to yielding limestone.

This is the history of the fine scars, which stand like coronary fortresses up & down the Kentucky valley. Piping water has found its way through the low points, ~~to eat~~ the carbonic acid in solution has eaten out a way through dense layers. Debris broken off by the canes or the other has fallen with the base of the cliff, until men stand, a round low place of limestone, with harder layers standing out like courses of heavy masonry, steep as the walls of castle, rising like a castle in effect.

It is not too much to say that these cliffs, or scarps, or even escarpments, to atmospheric denudation, or, indeed, they are the sole picturing feature the

low presents, for the limestone is ~~limestone~~ everly, you get long straight gulls, with ^{top as} good level as the coping of a wall, & steep worn broken sides, rather, as in Butterden Scar, above Kettlewell, you may shut in between two opposing cliff walls, & it is easy you are impressed between colossal walls.

Hilbreary Scar by Wharfe in Wharfedale, or Scar of Giggleswick near Settle, in Ribblesdale, a Malham Cove, & Gordale Scar in Wharfedale, are very fine examples of limestone scars. The two last, indeed, present some of the finest rock scenery in England. ^{Gordale Scar has no appearance quite equal to it.} Malham Cove ^{is} however, perhaps, the most perfect example of a great section of a vast amphitheatre, with proportionate course which may represent tiers of seats, 400 feet in height. At the foot of the cliff is a low arch, the mouth, spout, from this cave issues a clear stream, the upper air, but this is not the original source of the river: above the Cove, on the great limestone plateau of Malham, is a Malham Tarn, upon this Tarn issues a stream, which flows down helter-skelter above ground, then makes its escape through fissures in the rock, eats out a way for itself among the bowls of the plateau, is increased by other underground streams, & comes to light again, as we have seen, at the foot of Malham Cove.

Here we have an example of the history of cave-making: flowing water sinks through the fissure of the rock, & then, partly by erosion, partly by dissolution of the rock, enlarges

of the greatest and most thriving seats of manufacturing in the empire.

The great coal field reaches down into Nottinghamshire, but an interval is with that part of it situated within Yorkshire. A strip of the Lower Coal Measures, upon which stand Leeds, Bradford, Halifax, Huddersfield, borders the central mass of the Middle Coal Measures, wherein are Wakefield, Barnsley, Sheppfield, Rotherham.

Perhaps the best known coals of the Lower Coal Measures in Yorkshire are, the Better Red Coal of Bradford, a bright-coal, very fine from sulphur, used in working the low iron ironstone.

The latter exists in layers, never more than two feet in thickness, far above the Coal seams, & perhaps owes its celebrity for superior long-burners as much to the excellence of the Better Red coal employed in smelting & refining it - as to qualities of the ironstone. The Benton Coal over Leeds, is another valuable bed, the seam having the unusual thickness of six feet - in some places.

Of the Middle Coal Measures, so-called as being less deeply buried than the lower measures, perhaps the most valuable seam is the Cilferton coal, reaching from the southern boundary of the country as far north as ~~Cantbury~~^{Leeds}, above Barnsley. The seam has a thickness of one or half feet, though it is divided into two beds by a layer of powder-clay, a few inches thick. This is excellent house-coal, a great deal of it is sent to London. This is succeeded to the north by the Kelving coal.

1891-92

Coal, a seam at about the same level of the Calkestone, but of poorer quality, which reaches northwards nearly to Leeds. A much higher level is the celebrated Barnsley Bed, the most prolific in Yorkshire. A seam more or less feet in thickness in the neighbourhood of Barnsley, the coal-bounding out beyond Cheppel to some form or fair part, a bed above soft top & bottom layers much food household coal, still the prime, close centred portions supply steam-making coal.

We come now to the question, under what conditions were these coal-beds laid down. The deeply laid foundation of the prosperity of the West Riding? We must carry our investigation back to a period which we can only describe as among millions of years ago. Somany changes have often place in the interval, that, over the coal measures in ~~situ~~ ^{situ} they would lie at a depth of fifty thousand feet, that is, very could be utterly & infinitely out-of-reach. But - throughout the long geological periods since have elapsed since the laying down of the coal, the crust of the earth has ~~seen~~ undergone many plutonic upheavals, causing cracks & 'faults' in the solid strata above. & thus the coal has been brought up just to surface, & - any rate within measurable & workable distance.

This black rock is ~~heavily~~ weighty: it is the only rock of ~~vegetable~~ origin which forms any considerable part of the earth's crust. This is, roughly, its history: - We have seen that the area including the centre of the British Isles which we have spoken of as occupied by an inland sea, was subject to alternate eras of elevation

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as dry land submergence as the bed of a
sea or lake, that is to say, the sandy bottom was
probably always either rising very very gradually,
or sinking or gradually, when it was higher
above the water, and it was dry land; when
it had sunk below that level, it was the bottom
of sea, each such change was the work of ages.
Now during each of these periods - elevation, subsi-
dence and soil upon the sandy bottoms, & forests grew
upon them. Did such forests as grow in the
same latitudes now: the conditions were different:
the climate & soil were perhaps not unlike
now of the swamps which form the bottom
state of ~~Bethel~~ ~~Conn.~~ bordering on the Bay
of Minus. The equable temperature, humus
and atmosphere & rich soil favored
rarely tropical vegetation, & the water from
dark mosses & forest-ticks for the most part
but developed into forest trees soon only
just high. Sepidodendron, Ligustrum
& Calamites, often with tree-ferns, &
rich underwood of lesser ferns, & soft
spines on the higher levels. How these forests
decayed, over slowly submerged, over
compressed ^{by} the earliest of hydrante
process, the weight of the sea above them;
how they forests were overlaid by a new
sandy sea-bottom, which went through the
same history of gradual elevation, by reason of its
own ever increasing thickness. Then, predominating
then, submergence, as to last; how this was
repeated again again, how often we have ~~seen~~
no means of judging, not, gully a hundred
different seams of coal, each divided by the

ADDITIONS

under clay, which held a still wider space to the roots of the forest
than has been laid bare in the South Wales coal field: This
is to say, there, a hundred times within human memory
has the land risen, torn forests, stems again
submerged. We cannot follow the workings, the
chemical changes which took place in these buried
forests - the keeping burning black which took place
in the moist mass, its change into a pulpy
condition, therein distinct vegetable forms,
leaves, fruit, &c., were almost entirely lost,
& lastly, the change into the hard, solid, semi-lithified
~~masses~~ ^{which} reappeared with. We cannot enter
into the details which show the conditions which
prevailed during the formation of this or that
particular bed, without account for the
differences in quality between coal and coal, but
enough has been said to account for the
several states of the coal measures, - now,
the grit or sandstone of the old sea-bottom, now,
shale, the soil of river mud laid upon the
elevated sandbank, therein the forest green, then
coal, then sandstone again, soon. Here
too, we have to reason by an old bed which
underlie another, and by again geologists should
divide these underlying coal beds into three
series - lower, middle, & upper.

Since the laying down of the Carboniferous strata,
most successive periods & formations have
occurred, so that ~~they~~ ^{with upper rock} appear in Yorkshire
in the curiously consecutive order we have
noticed - the Permian state, Liassic, Lias,
Bolite, Cretaceous, & recent, ~~as~~ ^{being new deposits,} appear on the
surface, to say nothing of the glacial drift which
fills the Vale of Pickering.

it is worth while to consider the character of this limestone district.

In several Mr. Wherry, Airy & Ribble have all cast many nets upper valleys out-of-the solid limestone, & their upper courses give opportunity to study the characteristics of limestone country. Upper Wharfedale, ~~from below~~^{from below} Burnsall & Deepdale, is perhaps the most beautiful & the most characteristic of these valleys. Like the Lee, the Wharfe is -

"Condemned to run a channel adown
In cold sheets of marble grey."

& the clear brown waters, brown, from the peat-mosses where they rise, course through a clean-swept channel, of grey slabs. Every now & then, enormous boulders break the current, driving the waters into pleny; then, the peat bed of the rock is set off by deposits of the richest, darkest mosses. Alders hang over the streams a little higher, or hazel thickets with birch or rowan for variety; & in the thickets of the limestone hills above, the cold grey-green of the ash is the prevailing tint. A special feature of this limestone country is the lovely lawn. like meadow & pastures which fill the lower valley; lawn-like that is, after the first & second cutting of the hay, but-lovely always, for it is the property of the limestone where a close, short, vividly green turf-peppered brightles than the delicious turp of the chalk, though less in selecte. The flowers are very abundant - lovely, the handsome ~~and~~ wild per-

ferns, mosses, & on sagebrush, rock cists, several species of orchid, the yellow penst., many mtn. flowers & ferns. The great beauty & variety of the mosses & lichens is another feature of the limestone country. Some of them are designed to adapt to the pale rock, while the low top of many a hill offers a paradise to the ferns & other. I know of no bush hill, but will not do its whereabouts, where the hill top is paved with limestone ^{slabs} like enormous ^{flat} gravestones, from the crevices, about a ^{hundred} square yards between these slabs, are ~~now~~ ^{now} numerous ferneries, every plant perfect, delicate in hue as if reared under glass. You will find the Limestone Polypody, (Polyodium coloratum), the Green spleenwort, (Athyrium filix-femina), the black Maiden-hair Spleenwort, (O. Adiantum-nigrum), the seal fern, (Ceterach officinarum), the common hart's-tongue, (Asplenium vulgare), very abundant - Spleenwort, in fact all the ferns peculiar to the limestone.

Now, on this hill & indeed on all the hills, on the beds of the rivers & scattered freely throughout Craven, are oddly shaped masses, like huge bleached skeletons, worn smooth by the weather. Even the trunks of trees are bald in the ground for centuries. Much like vegetable or animal remains as they look, then on limestone boulders, worn into their fantastic shapes by the action of water. Indeed, all the peculiar & very picturesque rock scenery of Craven is due to the extraordinary effect that moisture has upon limestone rocks.

The great thickness of limestone which overlies this part of Yorkshire is not to be thought of

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region presenting very different landscapes
showing very different geological conditions.
Now, following still the order of time, & beginning at
the North, we have first, the North-eastern Morland,
with vegetation not very unlike that of the
Western Morland, though supported on rocks
of a more recent origin.

Going south, we cross the Vale of Pickering.
~~full~~ ~~green~~ ~~extinct~~ verdant & fertile its
surface rock being the boulder clay of glacial
origin.

Next succeeds the Clift of the Wolds; lastly
Holderness, consisting of recent deposits,
the debris of the rest of the country.
Somewhat similarly as the landscape, &c., changes. The
agricultural manufacturing industries of
a district connected with its geological formation,
that Yorkshire may be roughly paralleled with
some six or seven series of landscape
corresponding with the geological eras mentioned above,
as may be indicated.

The Silurian rocks, infinitely the oldest series,
which Yorkshire exhibits, - appear only in one
or two places. You are surprised to come
upon quarries of bluish-green slates in
the neighbourhood of Ingliston, & again, to
the north of Sedburgh, the same bed rocks
appear. How far the Silurian rocks underlie
the limestone we need not inquire here;
but the landscape industries of most
Yorkshire depend so largely on the Carboniferous
series, that we cannot give a more detailed account
of them.

In remote geologic time, a landlocked sea
occupied the centre of the space now occupied by

10 p.m. 1854

To British Seller a sea with many shell-fish, coral,
gymnophora, multitudinous marine animal
which formed their shells & harder parts of the carbonaceous
lime with the rivers falling into this sea constantly
brought down in solution. As countless generation
of these marine creatures died, the hard portion,
they had secreted fell to the bed of the sea. In
the course of ages, this perpetually rising deposit
of limestone nearly choked the sea, now wonder
for in the Craven district, this accumulation
of the ~~ancient~~ ^{some} remains of marine animals
reaches a thickness of 500 or 600 feet, while
in Derbyshire, which was also included in the
bottom of this ancient sea, a depth of 1000 feet
has been measured. Here we have the origin
of the Pennine Mountain. Carboniferous limestone
which forms a distinct upland belt of
peculiar character in the north-west of the
county. You may often see that the limestone
is simply a mass of shells, corals, encrusting, &c.
but more commonly, the shells are so broken
or so worn that the combined mass looks
^{compact} like a bluish-grey stone rock. The gradual
elevation & hardening into dry land of this
sea bottom is a process we can conceive of.
But, how is it that this enormously thick bed
of limestone we have spoken of should
not be continuous with the ancient sea
where it was laid, should not ~~it~~ ^{in Yorkshire, Lancashire,}
~~over the rest of the country~~
~~the south east~~ instead of being confined
to the north west? It does extend in this
manner, but, in the south east, it is buried
under an enormous depth of more recent
deposits. How these deposits were laid, we
may consider later, but, in the meantime,